



A HYBRID TECHNIQUE FOR EDGE DETECTION

Vivek Arya¹ | Dr. Jugendra Singh²

¹ Assistant Professor, Deptt. of EI, M.J.P. Rohilkhand University, Bareilly, India.

² Associate Professor, (Mathematics) Deptt. of Applied Sciences and Humanities, P.I.E.T., Panipat (Haryana), India.

ABSTRACT

In this paper a hybrid technique for edge detection is developed. This technique works in two step for edge detection. In first step, Canny Algorithm is applied for image smoothing and in second step neural network is to detecting actual edges. Neural network is an authentic tool for edge detection. As we know, it is a non-linear network with built-in thresholding capability. Neural Network can be trained with back propagation technique by using few training patterns but the most important task is to identify the correct training set.

KEYWORDS: Edge Detection, Gaussian Filter, Canny Algorithm.

1. Introduction

The digital image processing refers to processing digital images by means of a digital computer [1]. Edge detection is very important field in the image processing and computer vision. Edge of an image defines the boundaries of regions in the image. In segmentation and object recognition edge play an important role. Boundaries of an image represents important feature with small set of data. Nowadays, edge detection is used in bio metric machines, X-Ray, Satellite images, Shopping Malls etc. Presently many applications like image manipulation for movies, Identification wheat fields, registered cars identification details using plate numbers, optical character reorganization are commonly used.

1.1 Edge Detection

An edge in an image is a significant local change in the image intensity, usually associated with a discontinuity in either the image intensity or the first derivative of the image intensity. The quality of edges is affected by the presence of objects in similar illumination, noise and density of edges [2]. The variation in characteristics can leads to the variation in gray level of image. Edge detection is an important area for facilitating higher level image analysis and therefore remains an area of research with new approaches is continually being developed [3].

1.2 Canny Algorithm

Canny Edge Detection is most commonly used edge detection algorithm. In 1985, It was developed and then it became popular because of its good localization and better response in noisy environment. Canny Edge Detection algorithm is a multistage process used to detect the edges of the image [4-7].

1. Canny edge detector uses the first derivative of Gaussian to eliminate the noise in the image and produces a blurred image.
2. The edge can be in any direction vertically, horizontally or diagonally, so the edge detector operator returns the first derivative in vertical direction (Gy) and horizontal direction (Gx). Edge direction is identified by

$$Q = \arctan(Gy/Gx)$$

$$G = \sqrt{Gx^2 + Gy^2} \quad [1]$$

3. From the given values of image gradient, the direction of edge is calculated by comparing the gradient value with its local maxima. This step is also called as non-maximum suppression because it gives a wide range of edges including thin edges.
4. Now gradient values have been computed, after it thresholding is performed. The total number of edge points depends on the threshold value. Large the value of threshold produce small number of edges and vice versa.
5. Once applying the threshold, edge thinning is performed to remove the false edges. It eliminates all unwanted edge pixels.

3. Proposed Work

As Canny is popular for good results based on image smoothing. Neural Network is popular due to its high speed and accuracy. The architecture of proposed algorithm is given in Figure 1 and the architecture has various modules which are discussed as follows:

3.1 User Interface

User Interface is a space through which human interacts with the machine. Users submit their queries and then get their results on a user interface system. In our work, an input to the system is an image submitted through the front end of user interface and after processing result is displayed to user.

3.2 Input Image and Histogram Equalization

A two dimensional image is given to the system as an input. Any type of image black and white or RGB could be submitted as canny's will be applied to change coloured image into gray level image. By histogram equalization the number of pixels in each grey level equalized.

3.3 ANNY'S Gaussian Algorithm

In Gaussian smoothing, convolution operation is performed to smooth the image. In convolution operation, the image is blurred to remove the noisy effects from the image and image being smooth.

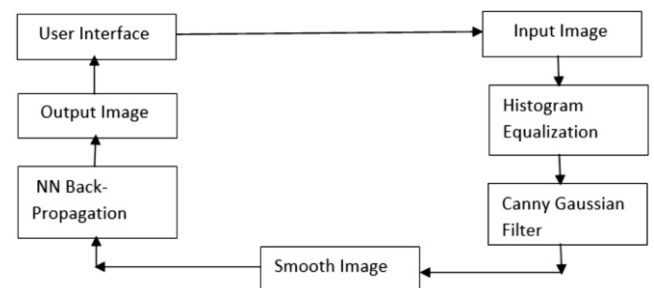


Figure 1. Proposed Edge Detection Architecture

3.4 Smooth Image

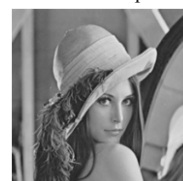
After applying the Gaussian filter, the resulting image will be the smooth image along with very less noise. Smoothed image is as input to actual neural network system to detect the final edges from the image.

3.5 NN Back Propagation

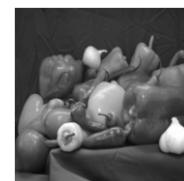
Neural Network's back propagation technique is popular technique that is commonly used for classification process. In the process of back propagation, a convolution matrix will be generated, a knowledge that actually generates the edge from gray scale image.

3.6 Output Image

After the operation of NN back propagation, the actual edged image will be obtained as output and presented to the user.



(a) Lena

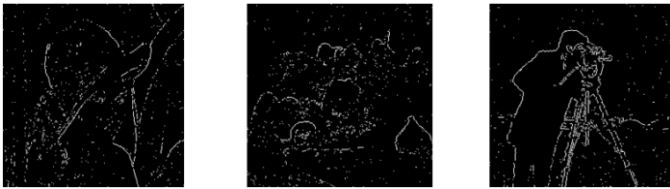


(b) Peppers



(c) Cameraman

Figure 2, Original Images



(a) Lena

(b) Peppers

(c) Cameraman

Figure 3, Edge Detection results

4. Results and Discussion

Performance of proposed algorithm was tested on various images. This proposed technique avoid the false edges produced by the noise and ensure that actual edges are correctly detected. As a result, the computational cost of the proposed algorithm is very low

As compared to the other existing edge detection algorithms and it require very less execution time. Therefore, we can say that the proposed algorithm works effectively for edge detection.

5. Conclusions

Many techniques are used for edge detection. Neural Network has the capability of work in noisy environment and gives very good results with high accuracy. In proposed work, Gaussian filter remove noise at large extent. Therefore, if they both are used in combined approach can produce better results as compared to other existing techniques. The purpose of this algorithm is to combine the advantages of canny techniques and neural network. The proposed hybrid techniques works efficiently and effectively.

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